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**Remarks**

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended to further clarify Applicants invention and define over the prior art by incorporating limitations from dependent claims.

Support for the amendments is found in the original and previously presented claims.

No new matter has been added.

**Examiners alleged Requirement for a Supplemental Oath or Declaration**

Examiner is clearly mistaken in alleging that Applicants have not disclosed in the originally filed Application;

An **oxygen containing buffer layer** or that the buffer layer accomplishes **reduced metal diffusion across a high-K dielectric interface**. Applicants have clearly previously set out support for the amendments e.g., in the Specification at paragraph 0031:

"For example, it has been found that without a buffer layer, according to prior art processes, that ion implants to adjust a Voltage threshold shift ( $V_{th}$ ) are insufficient to recover a desired Voltage threshold ( $V_{th}$ ) following formation of interfacial chemical bonds at a high-K dielectric layer/gate electrode interface. As a result, formation of a buffer layer according to embodiments of the present invention improves device performance by providing more stable Voltage thresholds and avoiding excessive Voltage threshold shifts in MOSFET device operation. **In addition, the buffer layer has the added advantage of preventing interdiffusion of metals, e.g., Si and high-K dielectric gate metals across a gate electrode/ high-K dielectric gate interface**, further improving device performance reliability. In addition, the buffer layer advantageously reduces oxygen diffusion through the high-K dielectric gate to the interfacial oxide to avoid lowering a dielectric constant, thereby avoiding device performance degradation."

In addition, Applicants have amended their claims to eliminate nitride and silicon nitride from a Markush group claim to clearly define over Li et al., who teaches a buffer layer on a high-K dielectric that may be made of **several types of nitrides including SiN** as well as metal silicides by polysilicon silicidation (paragraph 0030) and that the buffer layer may act as a reservoir for the ion implanted species **that can diffuse into the high-K dielectric layer** (paragraphs 0030; 0047).

Examiner has cited no support for the notion that an Applicants cannot amend their claims to define over the prior art, and such a notion is clearly inconsistent with Patent Examination guidelines.

### **706.07 Final Rejection**

Before final rejection is in order a clear issue should be developed between the examiner and applicant. To bring the prosecution to as speedy conclusion as possible and at the same time to deal justly by both the applicant and the public, the invention as disclosed and claimed should be thoroughly searched in the first action and the references fully applied; and **in reply to this action the applicant should amend with a view to avoiding all the grounds of rejection and objection.**

Moreover, if Examiner believes that Applicants originally filed Specification does not support the amended claims, the proper rejection would be a rejection under Section 101 alleging failure to meet the written description requirement or adding new matter, neither of which applies since Applicants have clearly disclosed the subject matter of the claims as amended. Examiners request for new oath or declaration amounts to a request that Applicants admit the subject matter is new matter, which is clearly not the case.

Nevertheless, Applicants present amendments address the issue with respect to **oxygen containing buffer layer**.

**Claim Rejections under 35 USC 102/103**

1. Claims 22-29, 31-35, and 39-42 stand rejected under 35 USC 102(e) as anticipated, or in the alternative, under 35 USC 103(a) as being obvious over Li (2005/0202659) or Chen (2005/0269651).

Applicants note that Chen is an improperly cited reference as it has a filing date of 5/25/2005 while Applicants filing date is 3/26/2004.

Examiner now asserts in response that Chen has a parent application with an effect filing date of March 26, 2004. Examiner has not cited the parent application, and there is no indication of the existence of a parent application or a priority date earlier than the filing date in Chen (2005/0269651). Examiner asserts that nevertheless "it remains

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that the claimed invention in the instant application has been known by others prior to the date of invention of this application". Applicants note that Examiners statement does not state any grounds of rejection under Section 102(e) and Examiner has not provided evidence that the reference qualifies as a rejection under Section 102(a), in order to be used in a 103(a) rejection.

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent,

Applicants nevertheless, while not admitting Chen is a valid reference, traverse Chen et al.

Chen et al. disclose (i) forming a high-k dielectric layer on a semiconductor substrate, (ii) subjecting the semiconductor substrate with the high-k dielectric layer to a nitrogen comprising vapor phase reactant and silicon comprising vapor phase reactant in a plasma-enhanced chemical vapor deposition process (PECVD) or a plasma-enhanced atomic layer chemical vapor deposition (PE ALCVD) process, in order to form within the high-K dielectric layer (by penetration of reactive species a lower

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intermediate layer including silicon, nitrogen and high-K dielectric and an upper dielectric layer without high-K dielectric, where the upper dielectric may include SiON (see Abstract; paragraphs 0011-0015). Chen et al. teach directly away from Applicants invention by teaching that that their process "Compared to prior art methods, the **formation of an interfacial layer between the high-k dielectric layer and e.g. the gate electrode layer is avoided**, thus leading to improved electrical properties". (see paragraph 0013).

Thus, even assuming *arguendo*, that Examiner could provide evidence supporting the validity of Chen et al. as a reference useable in a 103(a) rejection, Chen et al. teach directly away from Applicants invention and do not disclose the elements of Applicants invention, including those elements in **bold type**.

"an **buffer dielectric layer selected from the group consisting of a semiconductor-oxide, oxides, oxynitrides, silicate oxides, and silicate oxynitrides**, said buffer dielectric layer on the high-K gate dielectric, the **buffer dielectric layer further comprising dopants selected from the**

**group consisting of a metal, a semiconductor, and nitrogen;"**

Applicants further request that Examiner provide the Parent Application of Chen or a US reference thereto.

Li discloses a semiconductor device (MOSFET) with **an ion implanted high-K dielectric** to reduce impurity diffusion, increase crystallization temperature, and improve thermal stability of the high-K dielectric (paragraph 0029). **An optional buffer layer** 58 may (Figure 6b; paragraph 0046) or may not be (Figure 6a; paragraph 0045) formed on the high-K dielectric prior to ion implantation (paragraph 0030). Li teaches that the buffer layer may be made of **several types of nitrides including SiN** as well as metal silicides by polysilicon silicidation (paragraph 0030). Li teach that the buffer layer is beneficial to confine the implanted species to the high-K dielectric layer and that it may also act as a reservoir for the ion implanted species **that can diffuse into the high-K dielectric layer** (paragraphs 0030; 0047) in a subsequent annealing process. **Li teaches that if the buffer dielectric is TiN that both Ti and N may diffuse into the high-K dielectric to**

**improve the high-K dielectric (paragraph 0047)**. The buffer layer and the high-K dielectric are annealed following the implantation (paragraph 0046).

Li et al. show measurements comparing an HfON (**ion implanted**) to an HfO<sub>2</sub> High-K device showing an improvement in stability of V<sub>t</sub> versus changing gate Voltage (paragraph 0056), improved electron and hole mobility (paragraph 0057), reduced leakage current (paragraph 0058), improvement in subthreshold slope for a PMOS device (paragraph 0059), and improvement in time dependent dielectric breakdown (paragraph 0060).

Thus, the teachings of Li do not produce Applicants disclosed and claimed invention, but rather teach the use of a **nitride including SiN** buffer layer that defeats the purpose and operation of Applicants disclosed and claimed invention and therefore is insufficient to make out a *prima facie* case of anticipation or obviousness.

Thus, Li et al. do not disclose:



"an **buffer dielectric layer selected from the group consisting of a semiconductor-oxide, oxides, oxynitrides, silicate oxides, and silicate oxynitrides**, said buffer dielectric layer on the high-K gate dielectric, the **buffer dielectric layer further comprising dopants selected from the group consisting of a metal, a semiconductor, and nitrogen;**"

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

"**First**, there must be **some suggestion or motivation**, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. **Second, there must**

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**be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success **must both be found in the prior art, and not based on applicant's disclosure."** *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The teachings of either Li or Chen are clearly insufficient to anticipate or make obvious Applicants disclosed and claimed invention.

With respect to claims 23 and 24, Li et al. (or Chen) nowhere disclose Applicants dopant level and dopant type sufficient to accomplish Applicants stated function. Examiners argument claiming that the claims only claim function rather than structure is mistaken, the dopant level and dopant type are clearly structural features, and Examiner has not shown Applicants structure including a dopant level and type sufficient to accomplish Applicants function as a result of the claimed structure in the prior art.

Applicants further reject Examiners veiled assertion of inherency, and demand Examiner provide a showing in the prior art a dopant level and dopant type with respect to Applicants structure that is capable of accomplish Applicants function.

For example, see MPEP 2573.05(g):

A functional limitation is an attempt to define something by what it does, rather than by what it is (e.g., as evidenced by its specific structure or specific ingredients). There is nothing inherently wrong with defining some part of an invention in functional terms. Functional language does not, in and of itself, render a claim improper. *In re Swinehart*, 439 F.2d 210, 169 USPQ 226 (CCPA 1971).

"Even if the prior art device performs all the functions recited in the claim, the prior art cannot anticipate the claim if there is any structural difference." *In re Ruskin*, 347 F.2d 843, 146 USPQ 211 (CCPA 1965).

"The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic" *In re Rijckaert*,

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9 F.3d 1531, 1534, 28 USPQ (Fed. Cir. 1993).

With respect to claims 34 and 35, Applicants again reject Examiners assertion of official notice "regarding the conventional recitation/use of such materials" and further note that the purpose of the recited ion implanted dopants of Li is for a completely different purpose and effect (operates by a different principal of operation) than Applicants disclosed and claimed invention.

Moreover, Examiner has nowhere shown the equivalency of Applicants metal dopants to ion implanted Al in nitride (or silicide) buffer layers taught by Li et al. who further teaches that the metal dopants are taught to diffuse into the high-K dielectric layer to improve the high-K dielectric layer (taught by Li et al.), thus the fact that Li disclose Al as a metal dopant in a nitride or silicide layer is insufficient to make Applicants claimed Markush group obvious.

"In order to rely on equivalence as a rationale supporting an obviousness rejection, the equivalency must be recognized in

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the prior art, and **cannot be based on applicant's disclosure** or the mere fact that the components at issue are functional or mechanical equivalents." *In re Ruff*, 256 F.2d 590, 118 USPQ 340 (CCPA 1958) (**The mere fact that components are claimed as members of a Markush group cannot be relied upon to establish the equivalency of these components.** However, an applicant's expressed recognition of an art-recognized or obvious equivalent may be used to refute an argument that such equivalency does not exist.); *In re Scott*, 323 F.2d 1016, 139 USPQ.

With respect to claims 39 and 40, Applicants again reject Examiners assertion of official notice "regarding the conventional recitation/use of such materials" and further note that the recited high-K dielectrics in Li all contain metals **which advantageously diffuse into a high-K dielectric** (across a high-K dielectric **interface**, a problem which Applicants invention solves.

Further, Examiner has not shown the equivalence of Applicants high-K dielectrics and those taught in Li or Chen.

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2. Claim 30 stands rejected under 35 USC 103(a) as being unpatentable over Li or Chen, above, and further in view of Adetutu (2005/0085092).

Applicants reiterate the comments made above with respect to Li (and Chen).

Adetutu teaches forming a first dielectric layer on a semiconductor, introducing a **diffusion barrier material into the first dielectric layer** where the concentration of the diffusion barrier material (e.g., N) is at an upper portion of the layer, and **then forming a high-K dielectric layer on the first dielectric layer**. Adetutu teaches that the high concentration of the barrier diffusion material at the interface with the **overlying** high-K material prevents penetration of dopants across the high-K interface (Abstract; paragraphs 0012, 0013).

Thus, modifying the buffer layer of Li to prevent dopant diffusion across the high-K dielectric interface (in contrast to Li who teaches **the benefits of such diffusion**) would **change the principal of operation of the buffer layer of Li and make it**

**unsuitable for its intended purpose.**

**"Li teaches that if the buffer dielectric is TiN that both Ti and N may diffuse into the high-K dielectric to improve the high-K dielectric (paragraph 0047)"**

Thus, Adetutu nowhere suggests or discloses a buffer layer on a high-K dielectric layer and Li nowhere suggests or discloses that preventing diffusion is desirable, but rather teaches the opposite, that such diffusion is beneficial.

Moreover, **neither** Adetutu nor Li anywhere teach or suggests "wherein the dopants have a dopant concentration graded in decreasing concentration from the high-K dielectric layer/buffer dielectric layer interface toward the gate electrode layer".

**First**, there must be **some suggestion or motivation**, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. **Second**, there must be a **reasonable expectation of success**. Finally, the prior art

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reference (or references when combined) **must teach or suggest all the claim limitations**. The teaching or suggestion to make the claimed combination and the reasonable expectation of success **must both be found in the prior art, and not based on applicant's disclosure.**" *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *In re Ratti*, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).

"If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

3. Claims 36-38 stand rejected under 35 USC 103(a) as being unpatentable over Li or Chen, above, and further in view of Kim



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et al. (6,727,130) or Xiang (6,734,527).

Applicants reiterate the comments made above with respect to Li and Chen.

Even assuming *arguendo*, a proper motivation for combining the teachings of Li and Kim et al., the fact that Kim et al. teach that  $\text{Al}_2\text{O}_3$ ,  $\text{HfSiO}_2$  **can be employed in a gate insulating (dielectric) layer**, as Examiner alleges, also does not further help Examiner in producing Applicants disclosed and claimed structure, thus failing to make out a *prima facie* case of obviousness.

Even assuming *arguendo*, a proper motivation for combining the teachings of Li and Xiang, the fact that Xiang teaches "CMOS devices including gate materials such as hafnium silicates, aluminum oxide and their application in MOS devices including NMOS and PMOS devices, as Examiner alleges, also does not further help Examiner in producing Applicants disclosed and claimed structure, thus failing to make out a *prima facie* case of obviousness.

"Finally, the prior art reference (or references when combined) must teach **or suggest all the claim limitations**. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

4. Claims 22-24, 27-29, 31-32, 34, 35, 36, 39, 40, and 42 stand rejected under 35 USC 102(e) as anticipated, or in the alternative, under 35 USC 103(a) as being obvious over Bojarczuk (2002/0190302).

Bojarczuk teaches a diffusion/reaction barrier alternatively **on top of, underneath, or within a high-K dielectric layer** (paragraphs 0017, 0018; 0043) to prevent reaction between the gate electrode and high-K layer and to prevent diffusion of materials from the gate electrode into the high-K dielectric (paragraph 0029). Bojarczuk teaches that in the case the diffusion/barrier layer is deposited on top of the high-K dielectric, the diffusion barrier may be **nitride or**

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**oxynitride compounds such as AlN, ALON, SiN, SiON or SiN** (paragraph 0038; claim 2). Bojarczuk also teaches **in this embodiment (AlN, ALON, SiN, SiON or SiN)** that the high-K dielectric is **formed on the semiconductor substrate** (paragraph 0032).

Bojarczuk, therefore, fails to teach the elements of Applicants invention including those elements in bold type:

"an **buffer dielectric layer selected from the group consisting of a semiconductor-oxide, oxides, oxynitrides, silicate oxides, and silicate oxynitrides**, said buffer dielectric layer on the high-K gate dielectric, the **buffer dielectric layer further comprising dopants selected from the group consisting of a metal, a semiconductor, and nitrogen;**"

Bojarczuk nowhere discloses or suggests Applicants buffer layer dielectric materials or Applicants **further Applicants dopants** in the buffer dielectric layer, thus failing to anticipate or make obvious Applicants claims.

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See e.g., MPEP 2111.01:

During examination, the claims must be interpreted as broadly as their terms reasonably allow. **This means that the words of the claim must be given their plain meaning** unless applicant has provided a clear definition in the specification. *In re Zletz*, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989).

When not defined by applicant in the specification, the words of a claim must be given their plain meaning. In other words, they must be read as they would be interpreted by those of ordinary skill in the art. *In re Sneed*, 710 F.2d 1544, 218 USPQ 385 (Fed. Cir. 1983).

With respect to claims 31, 32, 34, 35, 39, and 40, Examiner is mistaken in equating the buffer dielectric layer AlN or AlON as having a metal dopant of Al. Bojarczuk nowhere discloses or suggests an **additional metal dopant** in a dielectric layer.

Applicants reject Examiners assertion of official notice "regarding the conventional recitation/use of such materials" and again note that nowhere does Bojarczuk disclose or suggest Applicants buffer dielectric layer further comprising a metal dopant.

"A claim is anticipated only if each and every element as

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set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

**First**, there must be **some suggestion or motivation**, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. **Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success **must both be found in the prior art, and not based on applicant's disclosure.**" *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

5. Claims 25, 26, and 41 stand rejected under 35 USC 103(a) as being unpatentable over Bojarczuk, above, and further in view of Green (2005/0042846).

Applicants reiterate the comments made above with respect to Bojarczuk.

Applicants further note that Green is an improperly applied reference since it has a filing date of 9/23/2004, post-dating the filing date of Applicants instant application. Green is therefore not further addressed. Examiner has not responded to the above fact and continues to apply Green. Thus, the fact that Green discloses an interfacial layer, as Examiner alleges is irrelevant.

Applicants again reject Examiners assertion of official notice "regarding the use of such conventional alternative materials for the interfacial layer" and again note that nowhere does Bojarczuk disclose or suggest an interfacial layer, but rather suggests the diffusion barrier layer underneath the high-

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K dielectric on the semiconductor substrate alternatively to being disposed on the high-K dielectric.

**First**, there must be **some suggestion or motivation**, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. **Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success **must both be found in the prior art, and not based on applicant's disclosure."** *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

6. Claim 30 stands rejected under 35 USC 103(a) as being unpatentable over Bojarczuk, above, and further in view of Adetutu, above.

Applicants reiterate the comments made above with respect to Bojarczuk.

Adetutu teaches forming a first dielectric layer on a semiconductor, introducing **a diffusion barrier material into the first dielectric layer** where the concentration of the diffusion barrier material (e.g., N) is at an upper portion of the layer, and then forming a high-K dielectric layer on the first dielectric layer. Adetutu teaches that the high concentration of the barrier diffusion material at the interface with the **overlying** high-K material prevents penetration of dopants across the high-K interface (Abstract; paragraphs 0012, 0013).

Thus, even assuming arguendo, a proper motivation for combining the teachings of Adetutu with Bojarczuk, the modification of Bojarczuk (introducing a diffusion barrier material into the first dielectric layer) does not produce a buffer dielectric layer on the high-K dielectric, but only modifies the diffusion barrier material underneath the dielectric and as such, does not produce or suggest Applicants disclosed and claimed invention.

Thus, Adetutu nowhere suggests or discloses a buffer layer



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on a high-K dielectric layer and Bojarczuk nowhere suggest or disclose Applicants buffer dielectric with additional metal dopants.

Examiner bald statement of obviousness is insufficient to make out a *prima face* case of obviousness. Examiner must show the existence of three requirements that are met by the prior art:

**First**, there must be **some suggestion or motivation**, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. **Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success **must both be found in the prior art, and not based on applicant's disclosure."** *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

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7. Claims 31-35 stand rejected under 35 USC 103(a) as being unpatentable over Bojarczuk, above, and further in view of Paton (6,703,277) and Chen, above.

Applicants reiterate the comments made above with respect to Bojarczuk and Chen, and therefore Chen is not further addressed since it is an improperly applied reference and Examiner has provided no evidence ore reference to apparent application having a filing date preceding Applicants filing date to show that it is a valid reference qualifying under section 102 for use in a 103(a) rejection. Moreover, Chen nowhere discloses a buffer dielectric layer on a high-K dielectric, but teaches that the formation of layers within the high-K dielectric by penetration of vapor phase species overcomes the necessity of forming a buffer dielectric layer on the high-K dielectric layer.

Even assuming *arguendo*, a proper motivation for combination, the fact that Paton teaches deposition of a metal layer on a high-K dielectric and diffusing the metal through the high-K dielectric to an underlying oxide interfacial layer that

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**reduces silicon dioxide to silicon and where the metal is then oxidized to form a dielectric material (interfacial layer)**

having a higher dielectric constant than silicon dioxide, does not further help Examiner in producing Applicants disclosed and claimed invention, and further would make the diffusion barrier layer of Bojarczuk (underneath the high-K dielectric layer) **unsuitable for its intended purpose.**

Applicants again further reject Examiners assertion of official notice "regarding the alternative of various metal dopants" and "the conventional recitation/use of such materials" and again note that nowhere does Bojarczuk disclose or suggest metal dopants in the nitride or oxynitride layers which cannot be equated to the metal component (Al) forming the metal nitride or metal oxynitride dielectric layers (AlN or AlON) i.e., one of ordinary skill would not interpret Al in ALN or AlON to be a metal dopant, as further taught by the cited reference Li.

**First**, there must be **some suggestion or motivation**, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the

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reference or to combine reference teachings. **Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success **must both be found in the prior art, and not based on applicant's disclosure.**" *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

8. Claims 36-38 stand rejected under 35 USC 103(a) as being unpatentable over Bojarczuk, above, and further in view of Kim and Xiang, above.

Applicants reiterate the comments made above with respect to Bojarczuk.

Even assuming *arguendo*, a proper motivation for combining the teachings of Bojarczuk and Kim et al., the fact that Kim et al. teach that Al<sub>2</sub>O<sub>3</sub>, HfO<sub>2</sub> **is employed in a gate insulating (dielectric) layer**, does not further help Examiner in producing Applicants disclosed and claimed structure, thus failing to make out a *prima facie* case of obviousness.

Even assuming *arguendo*, a proper motivation for combining the teachings of Bojarczuk and Xaing, the fact that Xaing teaches "CMOS devices including gate materials such as hafnium silicates, aluminum oxide and their application in MOS devices including NMOS and PMOS devices, also does not further help Examiner in producing Applicants disclosed and claimed structure, thus failing to make out a *prima facie* case of obviousness.

"Finally, the prior art reference (or references when combined) must teach **or suggest all the claim limitations**. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

#### **Examiners Arguments**

Examiner argues that the prior art teaching of a voltage shift is with regard to prior art that does not employ a buffer

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layer and that therefore in the prior art that employs a buffer layer that the voltage shift would have the same advantages since the prior art asserts improved device performance. Applicant do not know that prior art Examiner is referring to since there is no "page 16 of the remarks" Examiner nowhere refers to a Voltage shift in the prior art, but rather merely asserts that such a property is only a functional characteristic not entitled to patentable weight. Examiners assertion and appears to be a veiled inherency argument which Applicants reject.

Moreover, the prior art nowhere teaches or suggests "A gate structure with a reduced Voltage threshold ( $V_{th}$ ) shift and reduced metal diffusion across a high-K dielectric interface" Applicants discuss the problem to be overcome e.g., at paragraph 005:

"The presence of undesirable interfacial states and **diffusion of metals into the high-K dielectric** is believed to contribute to flatband and threshold Voltage shifts."

Examiner argues generally "that the enumeration of the

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numerous materials in these claims is fully anticipated by the prior art and in any event would not require any inventiveness or unobviousness". Applicants have noted in detail above, that Examiner has not shown Applicants structure (including materials and dopant levels) in the prior art, have reject Examiners numerous claims of Official notice. Applicants further note that Examiner asserts a novel standard for patentability that is nowhere found in the MPEP, the case law or the statutes; that Applicants structure (including buffer dielectric, additional dopants in the buffer dielectric, and dopant levels to solve a problem nowhere recognized or solved in the prior art "would not require any inventiveness or unobviousness".

Examiner responds to Applicants argument:

that **using the diffusion barrier of Adetutu** (with diffusion gradient of nitrogen to prevent diffusion of materials where the diffusion barrier is within the high-K dielectric) **to modify the buffer dielectric of Li** (who teaches that the buffer dielectric on the high-K dielectric advantageously acts as a **diffusion reservoir to allow diffusion** of species into the high-K

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dielectric to improve the high-K dielectric layer) changes the principle of operation of the buffer layer of Li and makes it unsuitable for its intended purpose.

Examiner responds that "this however overlooks the teachings of Adetutu, wherein concentration gradient in the dielectric can be employed to prevent unwanted diffusion".

Thus, Examiner overlooks the three clear requirements of making out a prima facie case of obviousness:

**First**, there must be **some suggestion or motivation**, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. **Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success **must both be found in the prior art, and not based on applicant's disclosure."** *In re Vaeck*, 947 F.2d 488, 20 USPQ2d



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1438 (Fed. Cir. 1991).

"we do not pick and choose among the individual elements of assorted prior art references to recreate the claimed invention, but rather we look for some teaching or suggestion in the references to support their use in a particular claimed combination". Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991).

### **Conclusion**

The multiplicity of cited references fail to produce or suggest Applicants disclosed and claimed invention and therefore fail to make out a *prima facie* case of anticipation or obviousness with respect to Applicants independent and dependent claims.

The Claims have been amended to further distinguish Applicants invention over the applied art by incorporating limitations from dependent claims into the dependent claims.

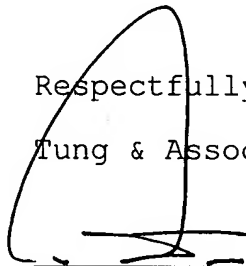
Based on the foregoing, Applicants respectfully request reconsideration of their Claims and submit that the Claims are in

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condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in condition for allowance for any reason, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,  
Tung & Associates

A handwritten signature in black ink, appearing to be 'Randy W. Tung', is written over a horizontal line. The signature is stylized with a large, looping initial 'R'.

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Reg. No. 31,311  
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